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PROMOTING PHYSICAL ACTIVITY AND EXERCISE AS ADJUNCT TREATMENT OF COGNITIVE DYSFUNCTION IN PSYCHIATRIC DISORDERS

PROMICANJE TJELESNE AKTIVNOSTI, KAO POMOĆI U TRETIRANJU KOGNITIVNE DISFUNKCIJE KOD PSIHIJATRIJSKIH POREMEĆAJA

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ABSTRACT

While psychiatric disorders are characterized by emotional disturbances, cognitive dysfunction is commonly encountered. Research evidence demonstrates that physical activity (PA) and exercise affect cognition in a number of psychiatric disorders. The best evidence supports exercise in slowing age related decline and rescuing cognitive function in dementing illnesses. Research also suggests that PA and exercise may be beneficial in improving cognition in schizophrenia, depression, and other psychiatric disorders. For many patients, a long period of physical inactivity and decline may have preceded treatment. Thus PA and exercise programs should follow an increasing progression of intensity level while providing interesting and stimulating variety of forms.

Key Words: Attention; Executive Function; Social Cognition; Neuroplasticity.

SAŽETAK

Iako su psihijatrijski poremećaji karakterizirani emocionalnim poremećajima, često se susreće i kognitivna disfunkcija. Istraživanja pokazuju da tjelesna aktivnost i vježbanje utječu na kogniciju kod mnogih psihijatrijskih poremećaja. Dokazi ukazuju na važnu ulogu vježbanja u spašavanju i usporavanju opadanja kognitivnih funkcija vezanih uz dob kod dementnih bolesti. Istraživanja također pokazuju da tjelesna aktivnost i vježbanje mogu biti korisni u poboljšavanju kognitivnih sposobnosti kod shizofrenije, depresije i drugih psihičkih poremećaja. Za mnoge pacijente, dugo razdoblje tjelesne neaktivnosti i nazadovanja je često i prethodilo liječenju. Stoga bi tjelesna aktivnost I vježbanje trebali pratiti postupno povećanje razine intenziteta i istovremeno predstavljati zanimljive i poticajne oblike aktivnosti.

Ključne riječi: pozornost, izvršna funkcija, socijalna kognicija, neuroplastičnost

While psychiatric disorders are characterized by emotional disturbances, cognitive dysfunction is commonly encountered. Research evidence demonstrates that physical activity (PA) and exercise affect cognition in a number of psychiatric disorders. The best evidence supports exercise in slowing age related decline and rescuing cognitive function in dementing illnesses. Research also suggests that PA and exercise may be beneficial in improving cognition in schizophrenia, depression, and other psychiatric disorders. For many patients, a long period of physical inactivity and decline may have preceded treatment. Thus PA and exercise programs should follow an increasing progression of intensity level while providing interesting and stimulating variety of forms.

Introduction

Although psychiatric disorders are widely recognized as having emotional disturbances, cognitive dysfunction is just as characteristic of most commonly encountered psychiatric disorders. Furthermore, in many disorders the cognitive symptoms are largely untreated by current medications and have significant impact on functional abilities (24). In response to these challenges a number of pharmaceutical, psychological and educational therapies have been developed. Recent research using animal models has identified that physical activity and exercise may play an important role in improving cognition. As such, it should be considered as an important adjunct therapy in the treatment of a number of psychiatric disorders. This paper presents some of the key cognitive deficits associated with the most common psychiatric disorders. In addition, a review is provided of the research linking physical activity and exercise to cognitive improvement, as well as proposed mechanisms of action.

Finally, implications and recommendations for practice and research are provided.

Cognitive Dysfunction in Common Psychiatric Disorders

Among the most common disorders with cognitive impairments are those associated with aging such as dementia and Parkinson's disease as well as psychiatric disorders such obsessive-compulsive disorder (OCD), post-traumatic stress disorder (PTSD) and schizophrenia. Finally, disorders more typically identified in childhood such as attention deficit hyperactivity disorder (ADHD) and autism spectrum disorders (ASD) also present with significant cognitive deficit. One cognitive function that is disrupted in virtually all disorders is that of attention (24). In cases such as dementia, ADHD and schizophrenia focused attention is disrupted (9), yet in disorders such as PSTD and OCD there is a hyper attention to threatening stimuli (6). Another aspect of cognition commonly disrupted in many disorders is that of executive function. Executive function is a cognitive component implicated in such activities as planning, decision-making and problem solving (24). Executive function also interacts with attention and working memory to permit people to act in non-routine environments. Aspects of executive function are disrupted differently in different disorders, for example children with ADHD demonstrate poor planning (28), cognitive inflexibility is characteristic in ASD (26), response inhibition is present in OCD (5), and schizophrenia demonstrated generalized deficits in many elements of executive function (16). Finally, social cognition, which is a form of higher cognitive function, is also impaired in many common disorders. Social cognition is cognitive process through which people perceive, interpret and respond to the assumed intentions and behaviors of others (13). Such behavior requires the creation of a mental understanding of others' thinking, referred to as theory of mind, as well as both receptive and expressive language skills. Social cognition is markedly impaired in ASD and schizophrenia, but also noted in depressive disorders, ADHD, Parkinson's disease and Alzheimer's disease (24).

Animal Models of PA & Cognition

Some of the earliest work to identify the relationship of PA to cognition was identified through a technique that has come to be termed environmental enrichment (29). Environmental enrichment involves providing an enlarged living space, increased social interaction as well as increased physical activity for laboratory animals. Using principally rodent models, physical activity and exercise regimen have been found to improve such cognitive function as spatial memory and learning (8), recognition memory (32) and working memory (20) among typically developing rodents. Exercise has also been found to improve cognitive functioning among animals whose cognitive function had been compromised by chronic stress (19), a viral model of schizophrenia (34), chronic ethanol consumption (14) and amyloidoisis (21). Thus in both normally developing as well as rodents with induced disorders, exercise regimen have been found to have beneficial outcomes for cognition.

Human Trials of PA or Exercise & Cognitive Function

The research to identify the impact of exercise and physical activity on cognitive function among humans is relatively young compared to the research on other non-human animals. For example, no human experiments appear in the research literature prior the late 1970s (e.g., 35). Given the challenges of cognitive decline in later adulthood, much of the research on PA or exercise and cognition has focused on older adults. One approach to examining the role of PA and exercise on cognitive function has examined this relationship among adults without cognitive impairment. In a review of PA interventions among adults without cognitive impairment Angevaren et al (2009) concluded that aerobic physical activity that improves cardiorespiratory fitness appears to be beneficial to cognitive speed as well as auditory and visual attention. At the same time, effects were not been uniformly demonstrated across all dimensions of cognitive function. A subsequent meta-analysis by Smith and colleagues (2010) concluded that aerobic exercise

confers modest cognitive improvements among older adults in the areas of attention and processing speed, executive function and memory. Another approach has been to examine the role of early life PA in later life cognitive impairment. Both retrospective and prospective study designs have been supportive of physical exercise as a preventative or disease modifying effect in later life (1). Among adults with already existing cognitive impairments, PA and exercise have also been found to improve general cognition, executive function and memory (30), and that the effect may be greater among those already experiencing cognitive decline (27).

The majority of research thus far examining the connection between PA or exercise and cognition has focused on older adults and dementing illnesses. There is a growing body of research that has also examined this connection in other types of psychiatric disorders. For example, recent randomized clinical trials (RCTs) have examined the effect of exercise on cognitive performance in schizophrenia. The evidence here is ambiguous as one small study found an effect (25), while a larger follow up study failed to find an effect (10). The research on the effects of physical exercise on cognitive performance is also limited. Among adults with major depressive disorder, exercise has been found to be associated with improvements in attention and inhibitory control (18, 31) and in one study it was more beneficial than an antidepressant in executive function improvement (15).

Similarly, there has only recently been interest in PA and exercise in other psychiatric disorders such as ADHD and ASD. Among children with ADHD, moderate to vigorous PA has been found to be associated with better executive function (7, 12), improvements in vigilance and impulsivity (23) and sustained attention (33). Overall, while findings are consistent with animal models and outcomes in other populations, the current research is notably weak in design (4). As with ADHD, the research on physical activity or exercise and cognitive improvement in ASD is just beginning. In one of the very few trials of physical activity in autism, Anderson-Haley, Tureck and Schneiderman (2011) found that the use of physically active video games resulted in improvements in some aspects of executive function; however, this was based on very small samples with no control condition. Finally, at present there are no identified studies that have examined the relationship of PA or exercise to the disorders of PSTD or OCD.

Potential Mechanisms of Action

Much of the work in the identification of mechanisms of action comes from animal models. Marmeleira (2013) provides a comprehensive review of potential mechanisms. One of the most obvious mechanisms is related to improved vascular fitness. This is characterized as the cerebral circulation hypothesis. Given the large demands of the brain for oxygen and glucose, one mechanism may be that improved fitness results in more efficient delivery of oxygen and nutrients to the brain. In addition, such improved vascular resources also promote angiogenesis, which while important to improved cognition is not sufficient cause for cognitive improvement (3). Another likely mechanism appears to be related to change in brain structures such as increased volume of the hippocampus (11). This is an important brain area for cognition due to its role in learning and memory, as well as its role in the expression of the neurotrophin brain-derived neurotrophic factor (BDNF). BDNF and other neurotrophic factors are important in the neuroplastic processes of neurogenesis, synaptogenesis, gliogenesis, and arborization (17). Finally, one hypothesized mechanism posits that through exercise, changes in the availability of neurotransmitters such as dopamine and noradrenaline may reduce depressive symptoms, which as noted above, impair cognitive processes (22).

Implications and Recommendations

There is sound research evidence to suggest that PA and exercise are important factors in aging and cognition. Regular PA provides both a prophylactic effect to cognitive decline and appears to be able to rescue age-related cognitive loss to some degree. The role of PA and exercise in cognitive impairment associated with other psychiatric disorders is less clear. While there is some evidence to suggest that it may have effects to improve cognition in a variety of disorders, the quality and number of supporting studies is quite limited. Another challenge in coming to conclusions about the research evidence in both human and rodent studies has been the variability of intensity and duration of PA interventions. Some studies have examined the role of vigorous exercise on cognition, whereas others have examined overall levels of physical activity. Duration also varies from a single bout to twelve months of exercise intervention. Another challenge in interpreting the research is that only some interventions collected data on both fitness and cognition. Without measuring changes in fitness level, it is difficult to determine if the PA or exercise intervention may have a direct or mediated effect (via vascular fitness) on cognition. Although there is only modest evidence for the effect of PA and exercise on cognition across all psychiatric disorders, increasing regular PA is warranted. First, from a fitness point of view, many of the cited disorders are associated with sedentary behavior, weight gain and obesity. Increasing regular PA can reduce the impact of such secondary health conditions. In addition, increasing regular PA may also increase the cognitive complexity of the lives of people with these disorders. Marmeleira (2013) noted that "nothing speeds brain atrophy more than being immobilized in the same environment and that the monotony undermines our dopamine and attentional systems crucial to maintaining brain plasticity" (p. 89). Finally, although may be clear benefits to PA and exercise, adherence is frequently challenging. For some people with psychiatric disorders, a long period of physical inactivity and decline may have preceded their treatment. High intensity exercise programs among such deconditioned clients may add to a low rate of adherence. Thus PA and exercise programs should follow an increasing progression of intensity level while providing interesting and stimulating variety of forms.

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